(12) UK Patent Application (19) GB (11) 2 059 621 A

(21) Application No 7933138
(22) Date of filing
25 Sep 1979
(43) Application published
23 Apr 1981
(51) INT CL³ G02B 7/26
(52) Domestic classification
G2J GEB
(56) Documents cited
GB 2012984A
GB 1544747
GB 1542194
GB 1540688
GB 1538195
GB 1534522
GB 1516788
GB 1419175
GB 1113719
GB 1111468
(58) Field of search
G2J
(71) Applicant
Standard Telephones and Cables Limited
190 Strand
London WC2R 1DU
England
(72) Inventors
Martin Chown
Anthony William Horsley
(74) Agents
Mr S R Capsey
ITT UK Patent Department
Maidstone Road
Foots Cray
Sidcup DA14 5HT
England

(54) Optical fibre connector

(57) A connector arrangement for an optical fibre 1 comprises an expanded beam termination 2 for the fibre and a reflection means 6, such as a prism, inclined at an angle to the optical axis of the termination 2. Typically the reflection means is one face of a prism, a second face of which is normal to the optical axis of the termination. If necessary a third face of the prism is treated to make it non-reflecting. When the prism is a so-called "roof" prism two such connectors may be used to make either a right-angled connection (Fig. 5a) or a substantially straight through connection (Fig. 5b). Other alternatives are described with reference to Figs. 7, 8 and 9 (not shown).

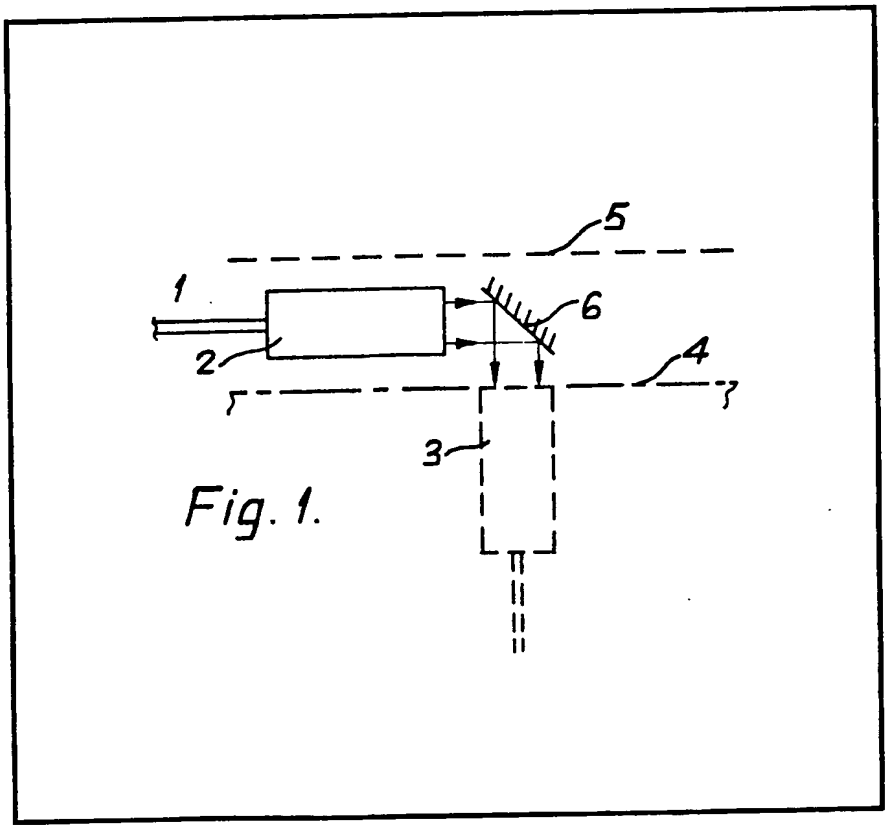

Fig. 1.

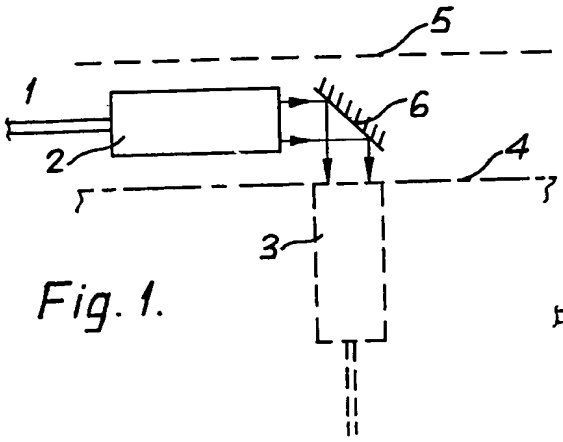

Fig. 1.

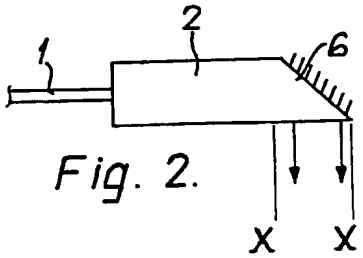

Fig. 2.

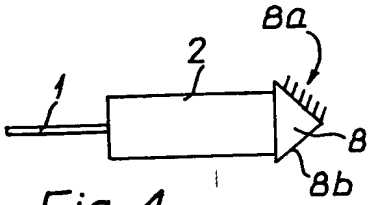

Fig. 4.

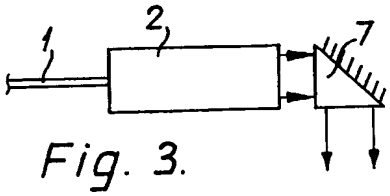

Fig. 3.

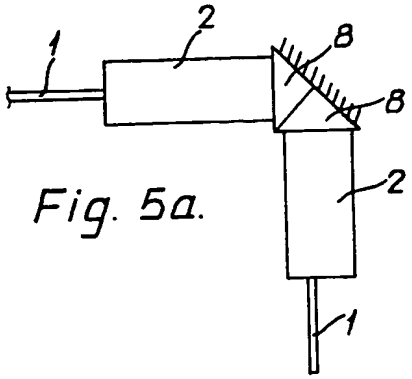

Fig. 5a.

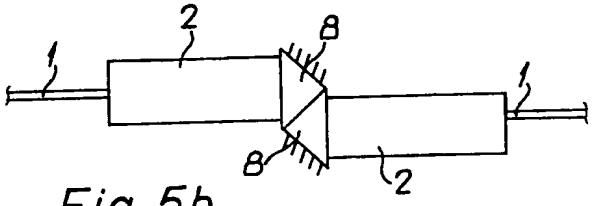

Fig. 5b.

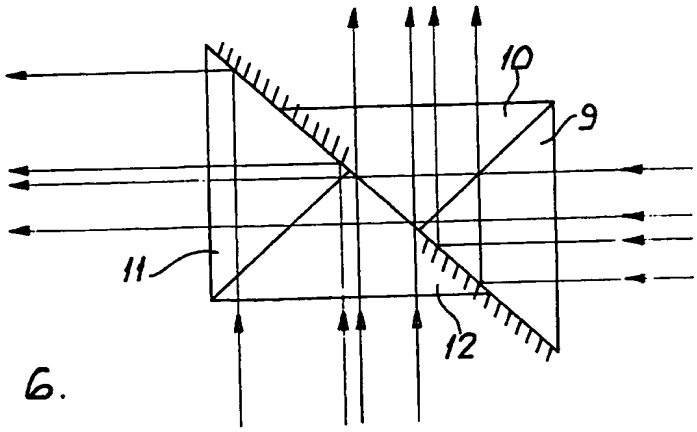

Fig. 6.

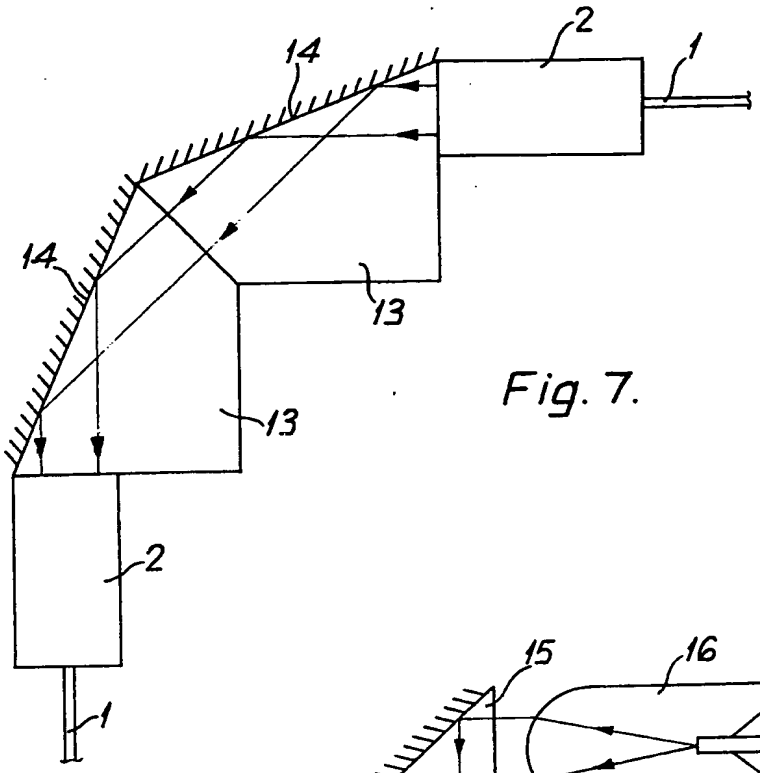

Fig. 7.

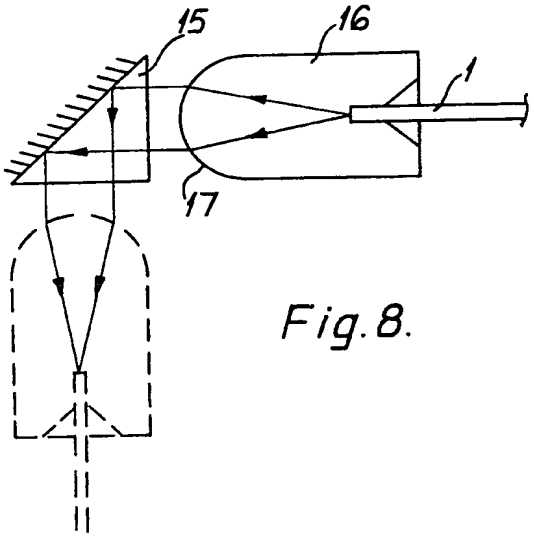

Fig. 8.

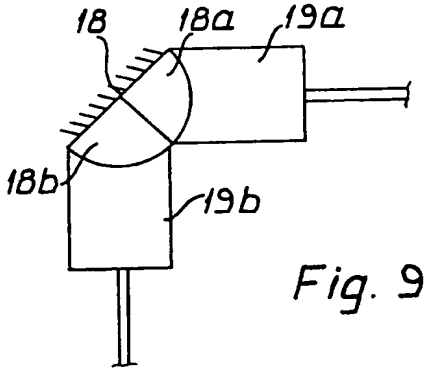

Fig. 9.

SPECIFICATION

Optical fibre connector

This invention relates to connectors for optical fibres.

It is sometimes necessary to make an optical fibre cable connection in a restricted space, either fibre-to-fibre or fibre-to-panel, and in corresponding situations in the electrical field this is commonly overcome by using right-angled connectors. In the case of optical fibre cable, right-angled bends in the cable are not obtainable. Optical fibre cables have only a limited bending capability and may even be restrained from too severe bending by a bend restrictor fitted over the end portion of the cable adjacent the connector (e.g. a so-called tapered "cow-tail"). In addition there may be a requirement for a length of "free" fibre within the connector to avoid strain.

It is clearly possible to make a right-angled connector by bringing the free fibre through a right-angle within the connector and this may be suitable when a butt joint is used. This technique is assumed to be obvious to those skilled in the art.

According to the present invention there is provided a connector arrangement for an optical fibre including an expanded beam optical termination the optical axis of which is coaxial with the axis of the fibre and flat reflection means adjacent and angled with respect to the optical axis of the termination.

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:–

Figure 1 illustrates the principle of a connector according to the invention,

Figure 2 illustrates a connector with integral reflection means,

Figure 3 illustrates a connector with a prism reflection means,

Figure 4 illustrates a connector with a "roof" prism reflection means,

Figures 5a and 5b illustrate applications of the connector of Fig. 4,

Figure 6 illustrates another application of the connector of Fig. 4,

Figure 7 illustrates a further form of connector with a prism reflection means,

Figure 8 illustrates a form of connector with a lentiform termination in combinaton with a prism reflection means, and

Figure 9 illustrates a connector with a lentiform relection means.

In the arrangement shown in Fig. 1 an optical fibre 1 is to be connected, via its expanded beam termination 2, with an optical device or another fibre termination 3 which may be, for example, mounted in a panel 4. To allow for such a connection where space above the panel may be restricted, as by other equipment 5 the termination 2 is arranged with its optical axis at a right-angle with the axis of termination 3. A reflection surface 6 inclined at 45° to the axis of termination 2 effects the optical connection between termination 2 and 3.

In one embodiment of the invention the termination 2 and reflection surface 6 are integral, as shown in Fig. 2. The termination 2 in this case is formed from a graded index rod the end face of which is an optically flat surface 6 inclined at 45° to the optical axis. If the rod is of square section then light reflected from the inclined surface is transmitted through the flat lower side surface of the rod in the region x–x. If the rod is of round section then a flat surface can be formed in the region x–x.

As an alternative to forming the reflection surface integral with the beam expanding terminal 2 the reflection surface may be provided by a prism, as shown in Fig. 3. The prism 7 is a right angled prism and reflection occurs at the hypotenuse face of the prism. The prism may be mounted close to or actually cemented to the end of the termination 2. In the above and other embodiments to be described the necessary housing and attachment means for the connectors have been omitted from the drawings, these will be readily designed by those skilled in the art.

In the arrangement shown in Fig. 4 a so-called "roof" prism 8 is used, i.e. a right-angled prism in which the hypotenuse face is cemented to the end of the termination 2. Normally total internal reflection occurs at both the other faces of such a prism. When used in the present circumstances however reflection is only allowed to occur at one of the faces 8a. The other face 8b is treated, as by the provision of an anti-reflection coating, to allow light reflected from the face 8a to pass freely therethrough. Two such connectors can be used to make a right-angled connection between two fibres, as shown in Fig. 5a, or a substantially straight connection, as shown in Fig. 5b.

Fig. 6 shows how connectors of the type shown in Fig. 4 can be used with modified connectors of the same type, in which both the right-angle faces have anti-reflection coatings, to provide optical couplers and splitters. Only the prism elements are shown in Fig. 6. Light entering prism 9 is split, part of the light being deflected through 90° and being emitted from prism 10, whilst the remainder passes straight through prism 11. Light entering prism 12 is similarly split, part of it being deflected through prism 11 and the rest passing straight through prism 10. By suitable positioning of the prisms relative to one another it is possible to control the ratios of reflected to unreflected light in the combination.

As an alternative to the use of right-angled triangular prisms, as described above, other shapes may be used. Fig. 7 shows the use of